Qualification Procedure for
SHEAR CONNECTOR STUD WELDABILITY

DOTD Designation: TR 601

I. Scope

The purpose of this procedure is to prescribe weldability tests which will qualify a shear connector stud for welding under shop or field conditions. The tests may be performed by a university, independent laboratory or other testing agency. The agency performing the tests shall submit to the manufacturer of the stud a certified report giving procedures and results for all tests including the information listed under Report of Tests section.

II. Duration of Qualification

A type and size of stud with arc shield, once qualified, is considered qualified until the manufacturer makes any change in the base of the stud, the flux, or the shield which effect the welding characteristics.

III. Preparation of Specimens

A. Test specimens shall be prepared by welding representative studs to the center of square specimen plates, 1/2 to 3/4 inch thick, of structural steel, ASTM A36. At the option of the manufacturer, studs may be welded to a large plate and the specimen platers cut to a size suitable for the testing equipment used.

B. Studs shall be welded with a power source, welding gun and control equipment as recommended by the manufacturer. Welding voltage, current and time shall be measures by suitable instrumentation and recorded for each specimen. Lift and plunge shall be at the optimum setting as recommended by the manufacturer.

C. Thirty test specimens shall be welded consecutively with optimum current and time. Optimum current and time shall be the mid-point of the range normally recommended by the manufacture for production welding.

D. Thirty test specimens shall be welded consecutively with time held constant at optimum but with current 10% below optimum.

E. Thirty test specimens shall be welded consecutively with time held constant at optimum but with current 10% above optimum.

IV. Qualification Tests

A. Tensile Tests – Ten specimens welded in accordance with III.C, ten specimens welded in accordance with III.D, and ten specimens welded in accordance with III.E shall be subjected to a tensile test in a fixture similar to that shown in Figure 1. A stud shall be considered as qualified if all test specimens have a tensile strength above the minimum requirements of Section 7, Stud Welding of the latest edition of *ANSI/AASHTO/AWS/D1.5 Bridge Welding Code*.

B. Bend Tests – Twenty specimens welded in accordance with III.C, twenty specimens welded in accordance with III.D, and twenty specimens welded in accordance with III.E shall be placed in the bend testing device shown in Figure 2 and bent alternately 30 degrees in opposite directions until failure occurs. A stud shall be considered as qualified if fracture occurs in the shank of the stud and not in the weld of all test specimens.

C. If a weld failure occurs in any of the tensile or bend test groups, that group may be retested. If the weld failure repeats, the stud shall fail to qualify.

V. Qualifications

For a manufacture's studs and arc shields to be qualified, each group of thirty studs shall, by test or retest, meet the requirements prescribed in Section IV.A and IV.B.

VI. Report of Tests

The laboratory report shall include the following:

- Drawings which show shapes and dimensions with tolerance of studs, arc shields and flux.
- A complete description of materials used in the studs and arc shields, including the quantity and analysis of the flux.
- A certification that the studs and arc shields described in the report are qualified in accordance with Section V.

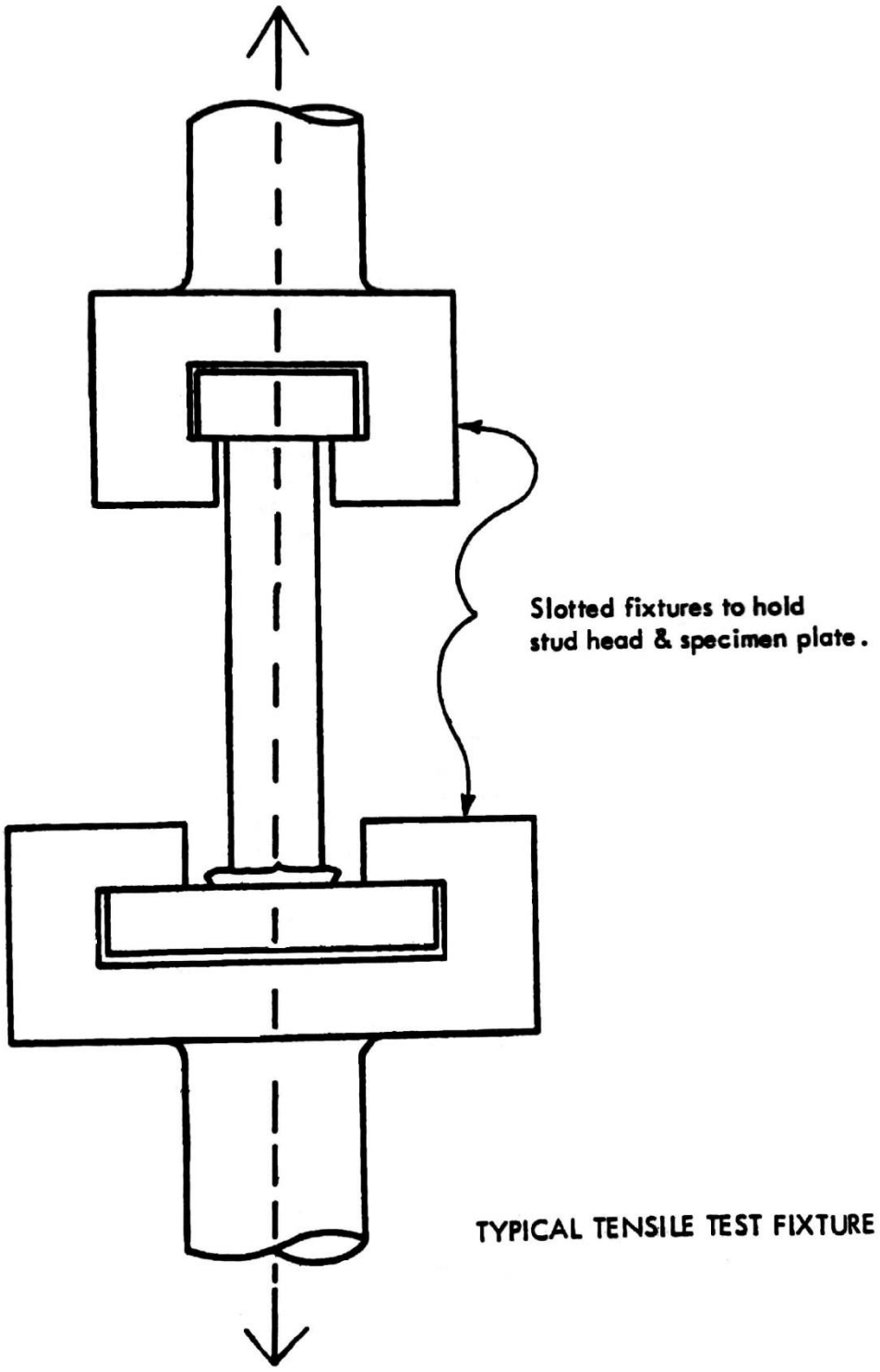

Slotted fixtures to hold
stud head & specimen plate.
TYPICAL TENSILE TEST FIXTURE

Figure #1

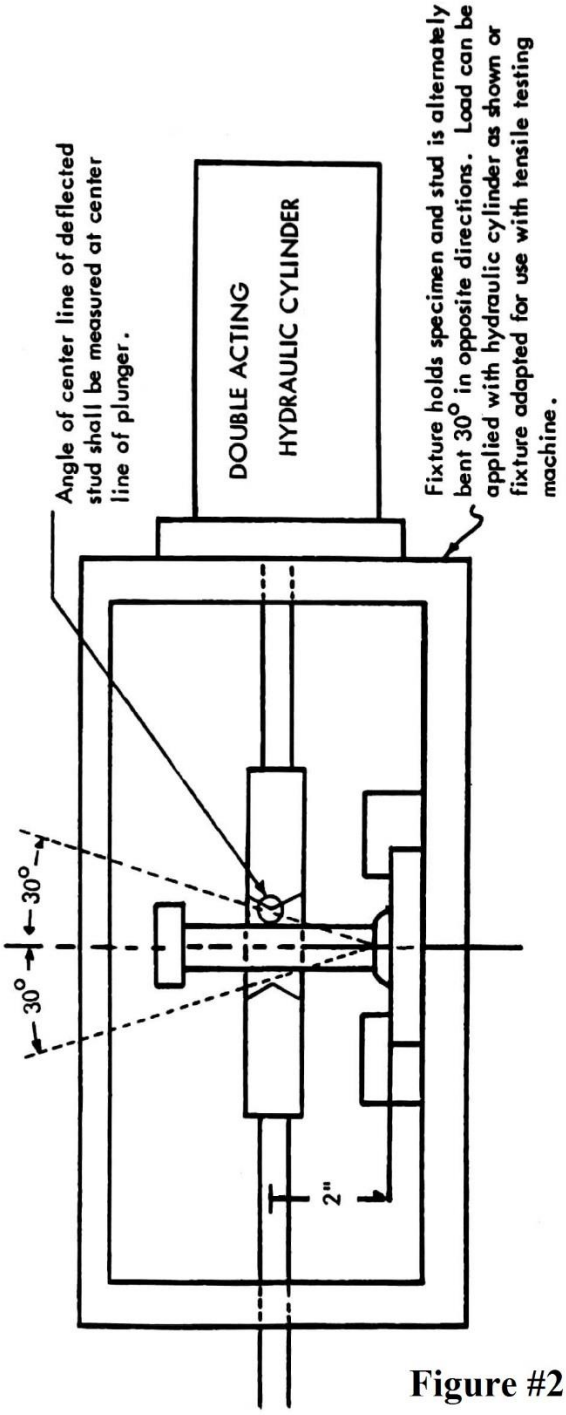
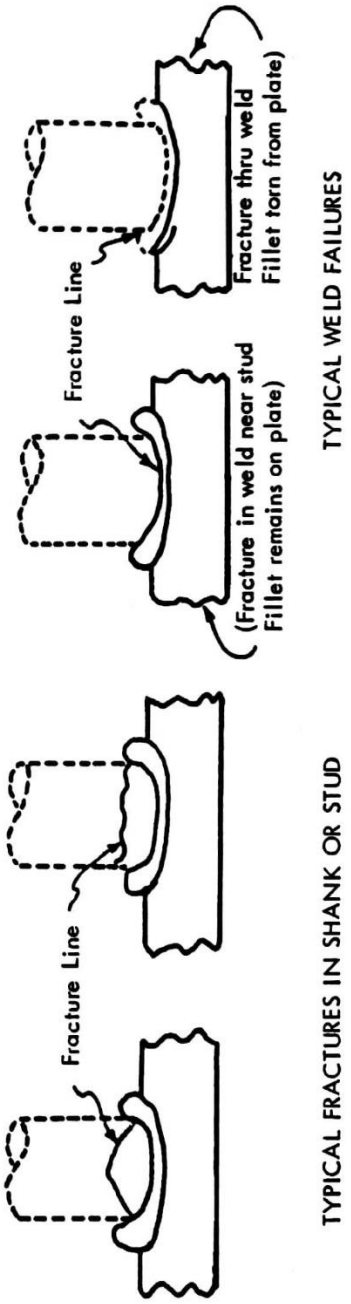

Angle of center line of deflected stud shall be measured at center line of plunger.
DOUBLE ACTING
HYDRAULIC CYLINDER
Fixture holds specimen and stud is alternately bent 30° in opposite directions. Load can be applied with hydraulic cylinder as shown or fixture adapted for use with tensile testing machine.
30°
30°
2"

Figure #2


Fracture Line
Fracture thru weld
Fillet torn from plate)
Fracture Line
(Fracture in weld near stud
Fillet remains on plate)
TYPICAL WELD FAILURES
Fracture Line
TYPICAL FRACTURES IN SHANK OR STUD